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New Risks and Old Problems: The Uncertain Outlook for Irish Agriculture

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New Risks and Old Problems: The Uncertain Outlook for Irish Agriculture

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Irish farming faces an uncertain outlook. The imminent risk of a damaging Brexit outcome looms large over the sector, compounding long-running concerns over low incomes. This *Economic Letter* assesses the recent economic performance of Irish agriculture in light of the current challenges. The analysis shows that beef and sheep farms (around 7 out of every 10 farms) face significant viability challenges and are heavily reliant on direct payments. Around one third of all farms are classified as economically vulnerable. Any future negative shock – even one less material than Brexit – would further expose the underlying weaknesses in the sector. In relation to Brexit, our analysis suggests that the negative impact on Irish farming will not be evenly distributed. With a greater dependence on low-margin beef farming, the West, Mid-West and Midland regions are both less resilient – and more exposed – than the South and East.

1. Introduction

The agriculture sector makes an important contribution to economic activity and employment in Ireland. In 2018, the agri-food output accounted for just under 8 per cent of modified national income (GNI*). Primary agriculture along with food processing and the manufacture of beverages employed 153,000 in Q1 2019, or just under 7 per cent of all jobs.[2] The agri-food sector generated just over €13 billion in exports in 2018, around 10 per cent of Ireland's overall merchandise exports. In rural areas, particularly in the Border and Mid-West areas, the contribution of agriculture to the local economy is even larger than indicated by these economy-wide statistics.

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[1] Irish Economic Analysis Division, Central Bank of Ireland. The views expressed in this paper are those of the author only and do not necessarily reflect the views of the Central Bank of Ireland. I would like to thank Graeme Walsh and Martina Sherman (Central Bank) for help with data and for comments. Thanks to Mark Cassidy, John Flynn, Brian Kenny, Tara McIndoe-Calder, Niall McInerney, Gerard O'Reilly and Paul Reddan for comments on an earlier draft.

[2] See LFS Detailed Employment Series: https://cso.ie/en/releasesandpublications/er/lfses/lfsemploymentseriesq12019/

Despite its sizable contribution to economic activity and employment, Irish farming has long faced serious underlying viability problems. It is in this context that the sector must address the risks that it faces today. The Central Bank estimates that a disorderly Brexit would reduce the long-run level of output in the economy by around 6 per cent with the majority of studies highlighting the particular exposure of the agri-food sector.[3] As well as Brexit, there are other risks from potential further trade liberalisation and reform of the Common Agricultural Policy (CAP). On top of these, the sector faces the challenge of how to reconcile ambitious targets for expansion in agricultural output with the need to contribute to reductions in Ireland's greenhouse gas emissions.

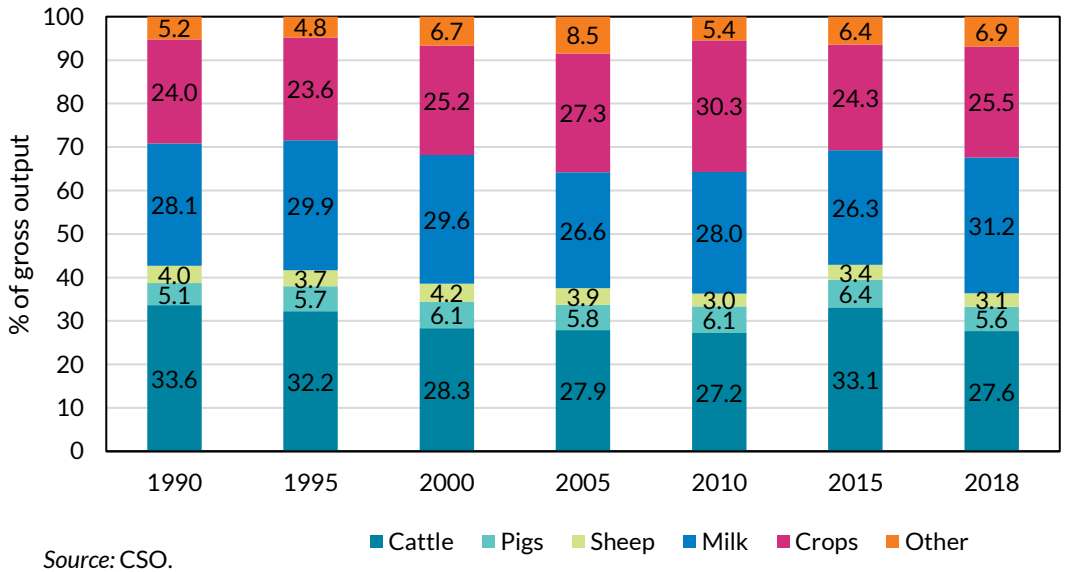
This *Economic Letter* describes the recent economic performance of the agriculture sector and discusses the key challenges, with a focus on the imminent risk of a disorderly Brexit. Section 2 outlines the performance of the agriculture sector in 2018 using the latest CSO data on output and incomes. Section 3 reviews a number of indicators of viability of Irish farming. Section 4 presents data on variation in farm type and size by region and uses this to consider the possible regional impact of Brexit. Section 5 briefly summarises the challenges facing agriculture in the context of Ireland's climate change obligations. Section 6 concludes.

2. Irish Agriculture in 2018

The structure of the agriculture sector is illustrated in Figure 1a which shows the share of gross output accounted for by the main commodities. In 2018, cattle and milk output accounted for almost 60 per cent of total gross output with crops accounting for around one quarter of output. Milk accounted for just under one third of gross output in 2018. Figure 1b shows the structure of agriculture by farm type based on the latest CSO *Farm Structure Survey* for 2016. In all, there were 137,500 farms in Ireland in 2016. Specialist beef production is the most common farm type or activity, accounting for over half of all farms in 2016 (78,300). Specialist dairy and sheep farms account for just under 12 per cent (16,000 farms) and 11 per cent (15,000 farms) of all farms respectively.

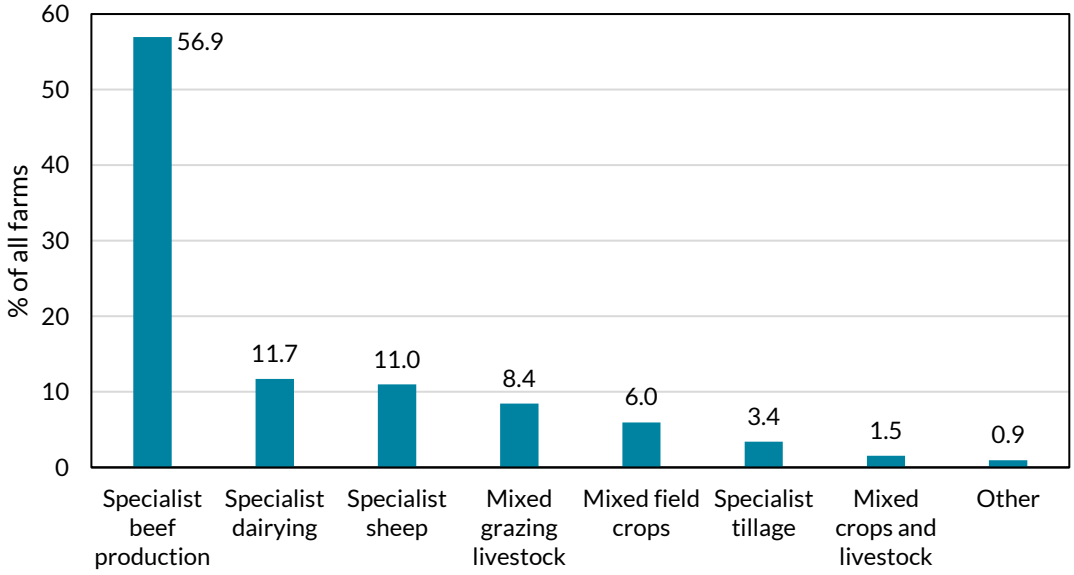
[3] See Bergin, Adele, Philip Economides, Abian Garcia-Rodriguez and Gavin Murphy (2019), "Ireland and Brexit: modelling the impact of deal and no-deal scenarios," ESRI Special Article. Available at: https://www.esri.ie/system/files/publications/QEC2019SPR_SA_Bergin.pdf .

Figure 1a: Structure of Agriculture: Main Commodities, % of Gross Output



Source: CSO.

Figure 1b: Structure of Agriculture: Farm Type as % of All Farms



Source: CSO *Farm Structure Survey 2016.*

Table 1 summarises the performance of Irish agriculture in 2018 using the latest data from the CSO's *Output, Input and Income* release published in July 2019. In 2017, the gross output of agriculture expanded by 14.5 per cent driven by an increase in the value of milk output. The positive price developments which contributed to the expansion in the value of milk output in 2017 were not sustained in 2018. According to the 2018 data, the value of milk output fell by 1.5 per cent as a fall in prices of almost 6 per cent offset an increase in the volume of output of 4.7 per cent. 2018 was also a poor year for the beef sector where the value of output fell by 4.3 per cent, with declines in both the volume and price of output. Although the volume of crops produced by Irish farmers fell in 2018,

higher prices resulted in an overall increase in the value of crop output, which rose by 14.6 per cent from €1.8 to €2 billion.

Despite the value of overall farm output increasing only marginally in 2018, farmers' expenditure on inputs increased by 13 per cent. The primary reason for this was a rise in expenditure on purchased feed of almost 27 per cent (€356 million). This is likely to have been due in part to the snowfall and inclement Spring weather which was followed by an exceptionally dry summer. These weather conditions reduced grass growth and led to an increase in purchased feed. Expenditure on fertilisers also increased sharply by 13 per cent. The combination of the large rise in input costs and only a small increase in output meant that gross value added at basic prices fell by 16.4 per cent in 2018. Depreciation on fixed capital is deducted from gross value added to arrive at net value added at basic prices. In 2017, this increased by almost 50 per cent or €770 million to €2.3 billion. These gains were largely reversed in 2018 as net value added declined by €576 million or 25 per cent.

The overall net value added of €1.7 billion from farming activities in 2018 was used in a number of ways:

- Just under €568 million was paid in wages (hired farm labour),
- €61 million was paid in interest on farm-related borrowing,
- €278.5 million went on land rental

Subtracting this expenditure from net value added means that family farm income at basic prices amounted to just €833 million in 2018. This represents the amount available to compensate farm families for their labour, the use of their own land and the return on their own capital invested. The extent to which the return on these inputs is poor is evident by the fact that there were 107,000 employed in primary agriculture in 2018, the agricultural land area was around 4.6 million hectares and the latest estimate of the capital stock in agriculture is just over €10 billion. The weak returns being earned by many farm enterprises highlights the importance of direct payments paid for by the EU under the CAP and by the Exchequer to Irish farm income. In 2018, direct payments amounted to €1.7 billion.

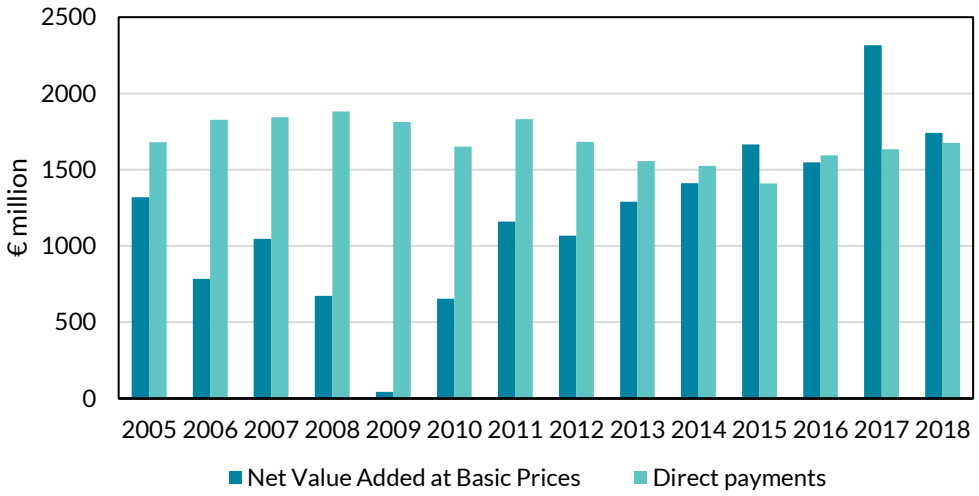
Table 1 | Output, Input and Income in Agriculture, € millions (unless indicated)

				% Change 2017-2018		
	2016	2017	2018	Value	Volume	Price
All Livestock	3439.8	3592.3	3447.0	-4.0	-1.2	-2.8
Livestock - Cattle	2288.9	2362.1	2261.1	-4.3	-3.1	-1.2
Livestock - Pig	465.2	516.8	458.6	-11.3	1.4	-12.5
Livestock - Sheep	255.7	262.9	253.2	-3.7	-8.7	5.5
Livestock - other	430.0	450.5	474.2	5.3		
All Livestock Products	1857.8	2668.7	2644.6	-0.9	5.1	-5.7
Milk	1790.8	2594.1	2555.4	-1.5	4.7	-5.9
Other Products (excluding Milk)	67.0	74.6	89.2	19.6		
All Crops	1767.4	1824.6	2090.2	14.6	-4.4	19.8
All Cereals	230.8	237.2	288.4	21.6		
Goods Output at Producer Prices	7065.0	8085.6	8181.8	1.2	-0.1	1.3
Contract Work	371.7	379.8	453.2	19.3		
Intermediate Consumption	5083.9	5311.0	6001.0	13.0		
of which feeding stuffs	1228.7	1324.4	1680.3	26.9		
Gross Value Added at Basic Prices	2359.9	3165.4	2647.8	-16.4		
Fixed Capital Consumption	812.5	848.5	907.2	6.9		
Net Value Added at Basic Prices (A)	1547.4	2317.0	1740.6	-24.9		
Other Subsidies Less Taxes on Production	1593.7	1633.9	1676.3	2.6		
Factor Income	3141.1	3950.9	3417.0	-13.5		
Compensation of Employees (B)	513.1	525.6	567.7	8.0		
Operating Surplus	2628.0	3425.2	2849.2	-16.8		
Interest less FISIM (C)	56.6	53.4	61.0	14.2		
Land Rental (D)	237.6	239.8	278.5	16.1		
Farm income at basic prices [(E)=A-(B+C+D)]	740.1	1498.2	833.4	-44.4		

Source: CSO *Output, Input and Income in Agriculture in 2018 Final Estimate.*
Notes: Rounding may affect totals.

Taking a longer-term perspective, Figure 2 charts net value added and direct payments since 2005. There are two noteworthy trends in the chart. The first is the exceptional volatility in net value added over time with increases in one year frequently followed by large reversals in subsequent years. This erratic pattern reflects the impact of sharp changes in prices of agricultural commodities over time but also the effect of weather-related events on farm output. Another notable aspect of the data in Figure 2 is that the value of direct payments exceed value added produced by farmers in all but three of the fifteen years shown in the chart. This illustrates the long-running reliance of farm incomes on direct payments, especially given the low absolute level and the volatility in the income generated from farming activities.

Figure 2: Net Value Added and Direct Payments, € million



Source: CSO.

3. Viability Challenges in Irish Farming

3.1 Farm Incomes and Direct Payments

Table 2 shows data on Family Farm Incomes (FFI) from the most recent National Farm Survey (Teagasc, NFS 2018). The National Farm Survey has been published annually since 1972 and provides detailed information on average farm incomes by type of farm system (dairy, beef, tillage etc.). Table 2 shows Family Farm Income and direct payments by type of farming activity for 2018. Despite falling by almost a third compared to the previous year, dairy farms had the highest family farm income in 2018 of €61,446. Tillage farms had the second highest FFI of just under €41,000. Cattle rearing farms had the lowest FFI of €8,331. The income on these farms was around one-third the average of all farms and around one eighth of the average income on dairy farms. On a per hectare basis, an average FFI of €1,047 was earned on dairy farms in 2018. The average income per hectare was lowest on cattle rearing farms where the figure fell to €270 in 2018, one quarter that of their dairy farm counterparts.

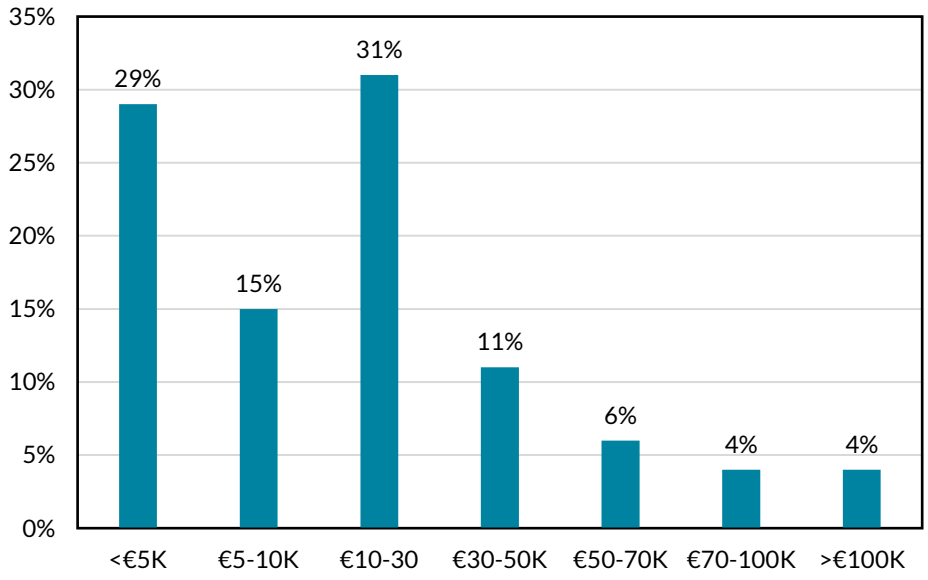
While the overall average FFI in 2018 was just over €23,000, it is interesting to consider how this was distributed across different income bands (Figure 3). The most notable aspect of Figure 3 is the concentration of farm income in the lowest income brackets. In 2018, almost 30 per cent of farms had an income of less than €5,000 while a further 15 per cent had an income of between €5,000 and €10,000. This means that almost 45 per cent of farms had an income (including direct payments) of less than €10,000 in 2018.

Table 2 | Average Family Farm Income and Direct Payments by System 2018

	Family Farm Income (FFI), €	Direct Payments, €	Direct Payments, % of FFI	Hectares (ha)	Income per ha, €
Dairy	61,446	21,022	34	59	1,047
Cattle Rearing	8,311	13,098	158	31	270
Cattle Other	14,560	16,226	111	37	391
Sheep	13,297	18,980	143	48	276
Tillage	40,650	22,451	55	60	675
All	23,333	17,244	74	43	541

Source: Teagasc *National Farm Survey*, 2018.
Notes: Rounding may affect totals.

Figure 3: Distribution of Annual Family Farm Income by Income Band, %



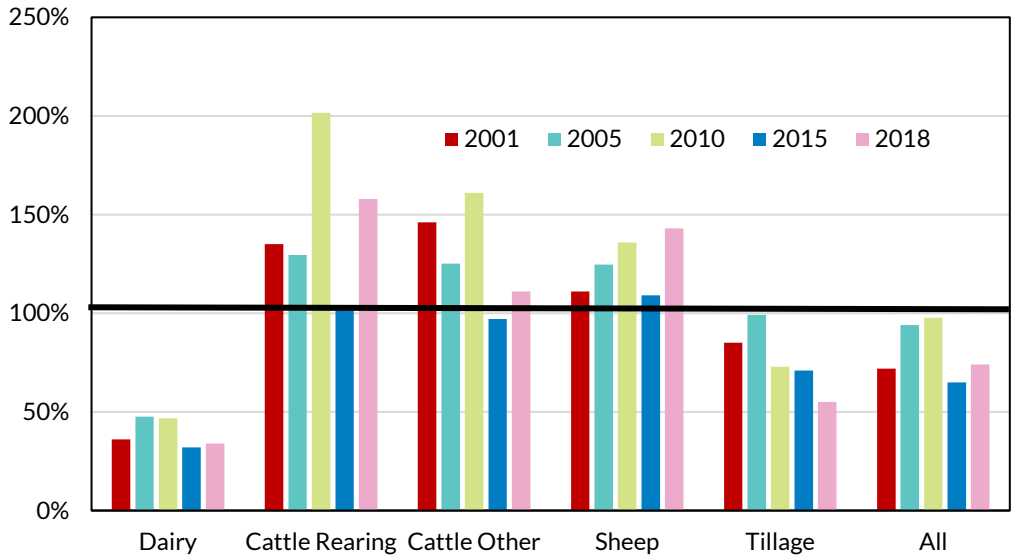
Source: Teagasc *National Farm Survey 2018*.

Table 2 also shows the average annual direct payment received across different farm systems.[4] The total direct payment received per farm in 2018 was €17,244, corresponding to 74 per cent of FFI. There is significant variation in the absolute amount

[4] Under the Direct Payment system a farmer's payment can be a combination of payment under four separate schemes: the Basic Payment Scheme, a "greening" payment for compliance with certain environmental and climate practices, young farmer's scheme and aid for protein crops.

of direct payments and their overall contribution to FFI across farm systems. For beef and sheep farms, the direct payment accounted for over 100 per cent of FFI. Direct payments as a percentage of income on cattle rearing farms was 158 per cent in 2018 (Teagasc, 2019). Where the direct payment exceeds 100 per cent of income, this indicates that these farms do not make a profit and are heavily reliant on support from CAP and other payments and supports.

Figure 4: Direct Payments as a % of FFI by Farm System



Source: Teagasc *National Farm Survey*, various years.

The dependence of beef and sheep farms on direct payments is not just a feature of the data in 2018 but has been consistently evident over a long period. Figure 4 shows direct payments as a percentage of FFI for five selected years from 2001 up to 2018. The chart shows that for cattle rearing and other cattle farms (over two thirds of the total), direct payments have accounted for close to or above 100 per cent of FFI in each year shown. The same result holds for sheep farming. This indicates that, on average, the market income (before direct payments) is less than zero on these three farm systems, which account for over 75 per cent of all farm enterprises. The chart also illustrates the stark divergence in profitability between dairy and all other farm systems, particularly cattle rearing.

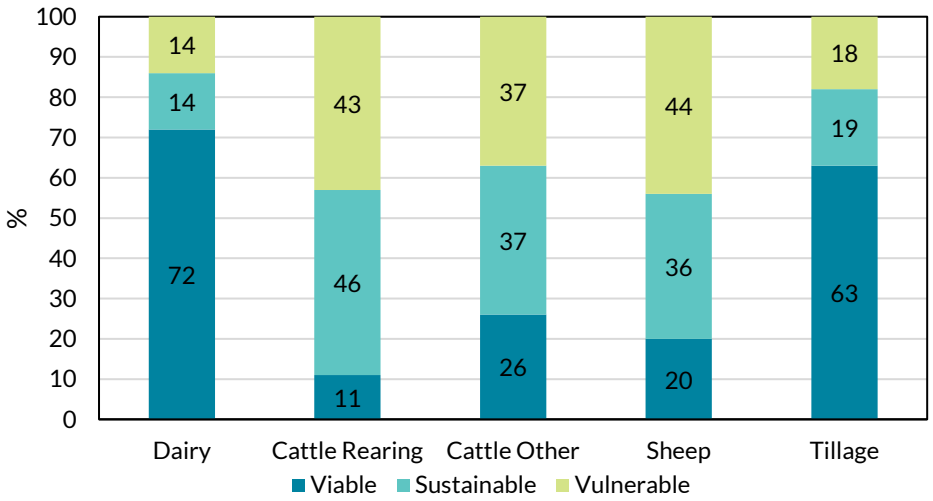
3.2 Viability

Using the data on FFI presented above, Teagasc's NFS estimates farm viability by type of system. Teagasc define three levels of viability: viable, economically sustainable and economically vulnerable. A farm business is defined as being *economically viable* if family farm income is sufficient to remunerate family labour at the minimum agricultural wage (which is assumed to be €19,616 per labour unit), and provide a 5 per cent return on the capital invested in non-land assets, i.e. machinery and livestock. Farms that are found not to be economically viable, but have an off-farm income source (either from a job, pension or social welfare) within the household, earned by either the farmer or the spouse, are

considered to be *economically sustainable*. Farm households are considered to be *economically vulnerable* if they are operating non-viable farm businesses and neither the farmer or spouse works off-farm. Based on the 2018 data, Teagasc reported that 34 per cent of the farm population represented by the survey were classed as being economically vulnerable, 34 per cent as sustainable and the remaining 32 per cent as viable.

Figure 5 shows the viability of farms across systems. Consistent with the data on income, there are very large differences in viability between dairy and the other farming systems, particularly beef and tillage. Around seven out of every ten dairy farms were found to be economically viable compared to around one in ten cattle rearing farms and two in ten sheep farms. Around two thirds of tillage farms were deemed economically viable in 2019.

Figure 5: Viability by Farm System 2018



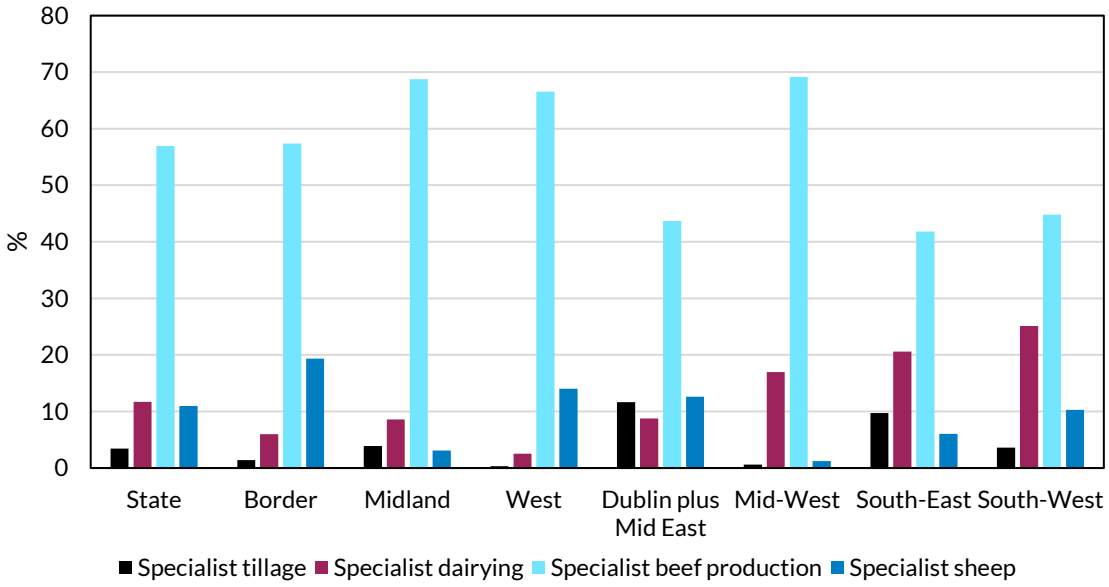
Source: Teagasc *National Farm Survey 2018.*

4. Brexit and Irish Agriculture: Sectoral and Regional Exposures

The weak underlying profitability of many farming enterprises means that the sector is exposed to shocks that would reduce demand for Irish agricultural output or lead to a fall in the price of the main commodities. The most imminent risk facing the sector is from Brexit. With 40 per cent of agri-food exports destined for the UK market, any form of Brexit which increases trade frictions between Ireland and the UK will have a negative effect on the sector. This section examines in detail some key characteristics of the agriculture sector, including how the type and size of farms varies by region. Understanding the composition of the sector sheds light on how Brexit is likely to impact sectors and regions differently.

4.1 Composition of the Agriculture Sector by Activity and Region

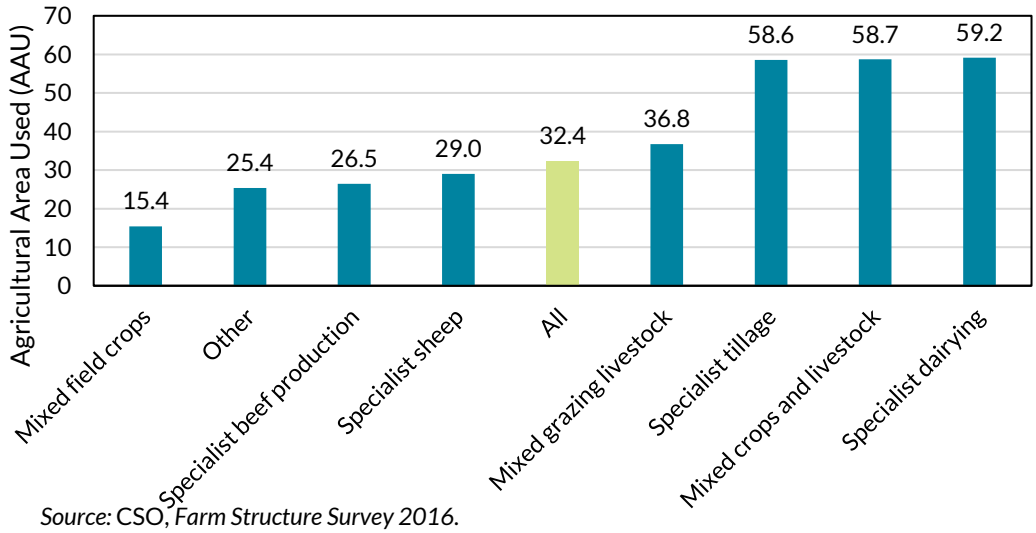
Figure 6: Distribution of Specialist Farm Types by Region (%), 2016



Source: CSO *Farm Structure Survey 2016.*

The distribution of specialist farm types by region is shown in Figure 6. While specialist beef production is the dominant type of farming activity at a national level, there is considerable variation in the importance of different farming systems across the country. The Midlands, Mid West and West are the areas with the highest proportion of beef farms at close to 70 per cent, well above the national average of 57 per cent. The South-East and South-West have the highest proportion of specialist dairy farms. Almost one-in-four farms in the South West are dairy farms, compared to around one-in-forty in the West.

Figure 7: Farm Size by Type of Farm, Hectares, 2016

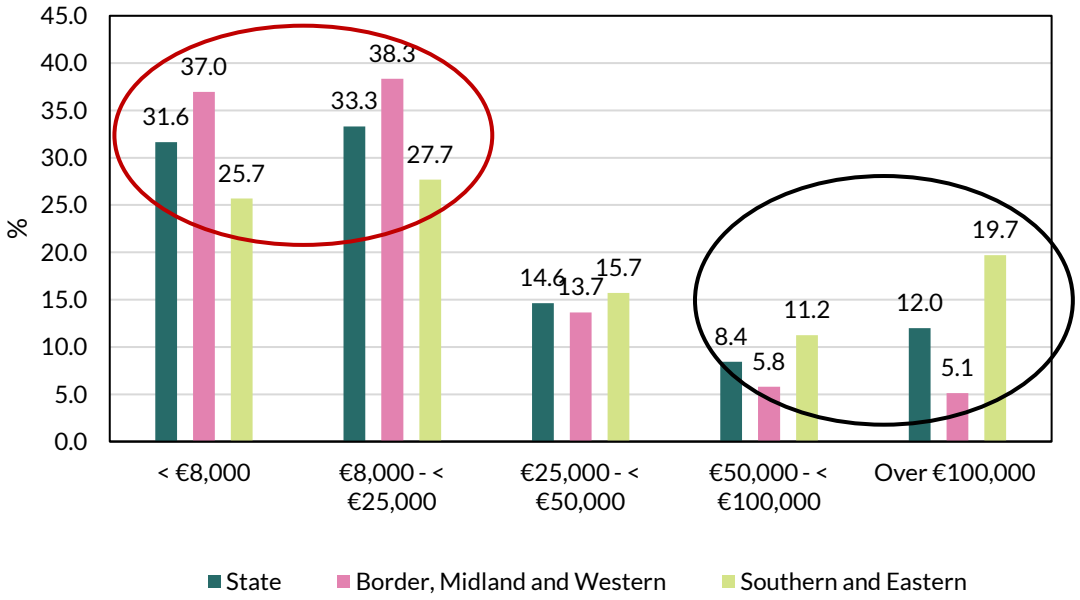


Source: CSO, *Farm Structure Survey 2016.*

Figure 7 shows farm size (hectares) by farm of activity. The average farm size in 2016 was just over 32 hectares. The average beef farm (over half of all farms) was smaller at 26.5 hectares. Dairy farms are the largest on average at just under 60 hectares, around twice as large as the average farm size across all systems.

Another measure of farm size is the value of standard output (Figure 8). Standard output is defined as the average monetary value of agricultural output at farm-gate prices. In 2016, the average Standard Output per farm was €45,855. The largest level of output was in the South-East region (€80,784) while the lowest was recorded in the West (€19,683). Figure 8 shows that a higher proportion of farms in the border, midlands and west (BMW) have standard output of less than €25,000 compared to the rest of the country. Conversely, farms in the south have higher output than the national average. In the southern and eastern region, around one in five farms had average standard output of over €100,000 compared to around one-in-twenty in the BMW region.

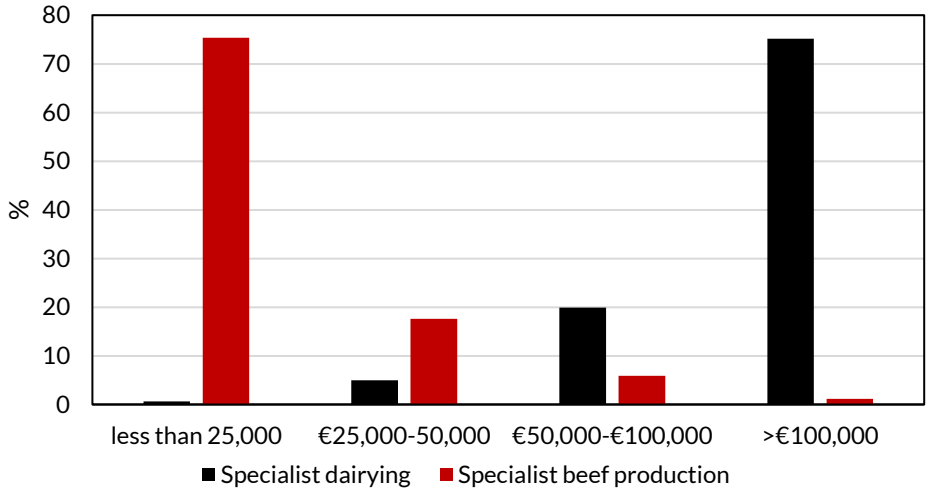
Figure 8: Farm Size by Value of Standard Output and Region, 2016



Source: CSO *Farm Structure Survey 2016.*

There is stark variation in the value of farm output depending on the type of farming activity being carried out (Figure 9). 75 per cent of specialist beef farms had standard output of less than €25,000 in 2016 compared to 0.1 per cent of dairy farms. In contrast, almost all Specialist Dairy farms (95 per cent) had a Standard Output of at least €50,000 and more than 75 per cent of such farms had an output of €100,000 and more. Just 1.2 per cent of specialist beef farms had output of greater than €100,000.

Figure 9: Farm Size by Value of Standard Output and System, 2016



Source: CSO *Farm Structure Survey 2016*.

4.2 Implications of Brexit

With beef and dairy accounting for around 7 out of every 10 Irish farms, it is useful to consider the implications of Brexit for these two sectors, drawing on the analysis above. Using the information on the distribution of farm systems, it is possible to identify differences in the likely impact of Brexit on the regions.

The overall effect of Brexit on Irish agriculture will be influenced by three factors:

1. The degree of reliance of specific sectors/products on the UK market.
2. The reduction in UK market access for Irish exporters due to tariff and non-tariff barriers.
3. The degree of resilience of different sectors based on their profitability and dependence on direct payments.

In relation to (1), around 90 per cent of Irish beef and milk (milk equivalent) output is exported. In the case of beef, 55 per cent of this is sold to the UK. For dairy products, the reliance on the UK market is lower with around 22 per cent of the value of exports going to that market (Hanrahan, 2018).

Regarding the impact of Brexit on access to the UK market (2), beef products would face the highest WTO tariffs. Lawless and Morgenroth (2016) estimate that the average implied WTO tariff on meat is close to 50 per cent. The average implied tariff on Dairy products is over 30 per cent. Both beef and dairy exports would be affected by non-tariff barriers which could have a particularly severe impact on agri-food trade in the event of a disorderly Brexit (Byrne and Rice, 2018). Given the lower dependence on the UK market and the lower tariffs, it is likely that the loss of UK market access will have a less severe impact on the dairy sector than for beef farmers.

In terms of the underlying resilience of the beef and dairy sectors (3), the evidence from the previous section is clear cut. Beef farms are smaller on average and make little or no market income. As a result, these enterprises rely heavily on off-farm incomes and direct payments. Dairy farms in contrast are larger, have the highest incomes and are the least reliant on direct payments.

Putting these different elements together, the beef sector stands out as being particularly exposed to Brexit. The sector is heavily reliant on the UK market, faces high tariffs in a hard Brexit scenario and has a significant concentration of smaller farms with low or negative market incomes. Teagasc estimate that only around one-in-ten beef farms were economically viable in 2018 (Teagasc, 2019). This represents the position in 2018 – before Brexit or the potential impact of trade liberalisation through deals such as Mercosur. It follows that any future shock which further reduced margins in the sector has the potential to aggravate the already strained financial position of most beef farmers.

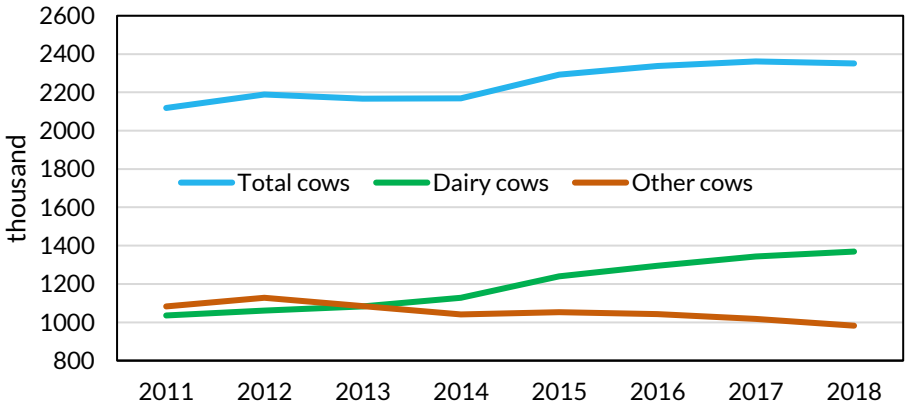
In relation to the potential regional impact of Brexit, it is possible to draw some conclusions. The data above show that there is a higher proportion of specialist beef farms in the West, Midlands and Mid-West. Close to 70 per cent of all farms in these regions are beef and up to 40 per cent of the farms have total annual output of less than €8,000. In contrast, more viable dairy farming is heavily underrepresented in these areas: 2.5 per cent of farms in the West are dairy compared to a national figure of just under 12 per cent. Since the beef sector is more exposed to Brexit, less resilient and likely to be more adversely affected than dairy, it follows that regions such as the West, Border and Mid-West with a high concentration of low-margin beef farms will be more severely impacted than the South and East, where dairy farming is more common.

A no-deal Brexit could have a severe impact on cross border trade arising from the imposition of tariffs and non-tariff barriers. The term non-tariff barriers covers a broad range of restrictions that impede international trade flows apart from direct tariffs. These can include quantity limits (quotas), technical requirements such as licensing, labelling, standards and rules designed to protect health and food safety. They also cover requirements on customs inspections and documentation and measures to restrict competition from imports to protect domestic firms. In a no-deal Brexit, tariff and non-tariff barriers would have a disproportionate effect on the agri-food sector which would experience the largest decline. In particular, Lawless (2017) shows that the negative effect of tariffs and estimated non-tariff barriers on overall cross-border trade is largely driven by their impact in the meat and dairy sectors.

5. Climate Change

The most recent report of the Climate Change Advisory Council contained a special focus on agriculture, discussing in detail issues related to agriculture and the environment in Ireland.[5] Agriculture utilises around 65 per cent of the land area of Ireland (4.5 million hectares), with 91 per cent of this used for livestock farming. Agriculture is the largest sectoral emitter, accounting for just under one-third of overall emissions. Across the EU, agriculture contributes around 10 per cent of emissions, highlighting the sector's outsized impact on the environment in Ireland. Since 2011, emissions from agriculture have risen by 14 per cent driven mainly by an increase in the size of the national dairy herd and a rise in nitrogen fertiliser use. Between 2005 and 2018, the number of dairy cows increased by 38 per cent, with the abolition of milk quotas in 2015 leading to a particularly pronounced rise over the years 2015-2018. Despite a fall in suckler cow numbers, this has resulted in a rise in overall cow numbers over this period (Figure 10).

Figure 10: National Cow Herd, Dairy and Other Cows, thousands



Source: CSO *Livestock Survey*.

Under the EU Effort Sharing Decision Ireland's target is to reduce greenhouse gas emissions by 20 per cent by 2020, relative to 2005 levels.[6] Based on emissions projections from the EPA, the most recent report from the Climate Change Advisory Council states that Ireland is likely to fall far short of meeting these targets, with a reduction in emissions of 5 to 6 per cent projected by 2020. The European Effort Sharing Regulation requires a 30 per cent reduction in overall emissions by 2030 relative to 2005 levels. Over the period to 2030, emissions from agriculture are projected to continue to rise with a 3 per cent increase on 2018 levels projected by the end of the next decade.

[5] See CCAC (2019). *Annual Review*. Chapter 8, "Special Focus: Agriculture, Forestry and Land Use."
[6] European Union (2018), Regulation (EU) 2018/842 of the European Parliament and of the Council of 30 May 2018 on binding annual greenhouse gas emission reductions by Member States from 2021 to 2030 contributing to climate action to meet commitments under the Paris Agreement and amending Regulation (EU) No 525/2013. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L_.2018.156.01.0026.01.ENG

Further increases in the dairy herd and fertiliser use are expected to be the main driver of higher agricultural emissions.

Given agriculture's significant contribution to overall emissions, the sector will be instrumental in ensuring Ireland's national climate change targets can be complied with. The CCAC have outlined a range options that could be adopted that have the potential to deliver significant emissions reductions.[7] These include: bovine related measures (such as extending the grazing season), soil management measures, carbon sequestration through an increase in afforestation, reductions in farm energy consumption and further research into mitigation options.

The CCAC also consider options involving reductions in the national bovine herd. In doing so, the Council reiterates a key point from the analysis in this paper, namely, that the majority of beef farming enterprises deliver a very low level of income to their owners and are not economically viable. Recognising the complexity of the issues and the need to ensure a fair transition, the Council's recommendations for policy change in agriculture and land use deserve careful consideration. These changes have the potential to improve the current dismal income position of beef farmers while at the same time delivering a reduction in greenhouse gas emissions. In this context, the forthcoming reform of the CAP will provide an opportunity for policy reforms to incentivise changes in the agriculture sector. Matthews (2019) presents one proposal for an extensification scheme that could reduce emissions from livestock and boost farm incomes.[8]

6. Conclusion

This *Economic Letter* examined the economic performance of the agriculture sector and assessed some of the key risks. There has been a significant expansion in output in the dairy sector over recent years. Dairy farms are in general larger than the average and the majority are economically viable. Other parts of the agriculture sector, however, face considerable challenges. In particular, the average income on cattle rearing farms in 2018 was just over €8,300, around one-eighth the income on dairy farms. Direct payments accounted for more than 100 per cent of farm income on beef farms, indicating that these farms made a loss on their farming activities. Low profitability and a high reliance of farm incomes on direct payments represent an important weakness in the sector and provides the context in which all other risks facing Irish agriculture should be considered. Viewed in this light, risks such as Brexit or trade liberalisation have the potential to further expose the existing viability challenges facing some Irish farmers

[7] The Marginal Abatement Cost Curve (MACC) produced by Teagasc details 27 measures related to agriculture, land-use change and fossil fuel displacement which can form part of an effective mitigation plan. See Lanigan *et al.* (2018).
[8] See http://capreform.eu/why-funding-a-suckler-cow-reduction-scheme-in-ireland-makes-sense/

The analysis examined differences in the structure of the agriculture across the regions. The results show a higher concentration of beef and sheep farming in the Mid-West, West and Midlands than in the rest of the country. In contrast, these areas have a lower percentage of dairy farms which are more prevalent in the southern half of the country. These characteristics have implications for the likely impact of Brexit. Since beef farming is both less resilient and more exposed to Brexit than the dairy sector, the areas of the country more dependent on beef farming, such as the West, will be more adversely affected than regions with a larger concentration of profitable dairy farms.

Given the poor viability of many farms in the beef sector, options should be explored that would have the dual benefits of safeguarding the incomes of farmers while also delivering reductions in Ireland's greenhouse gas emissions.

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